

CMOS Programmable Timer

High-Voltage Types (20-Volt Rating)

■ CD4536B is a programmable timer consisting of 24 ripple-binary counter stages. The salient feature of this device is its flexibility. The device can count from 1 to 2^{24} or the first 8 stages can be bypassed to allow an output, selectable by a 4-bit code, from any one of the remaining 16 stages. It can be driven by an external clock or an RC oscillator that can be constructed using on-chip components. Input IN1 serves as either the external clock input or the input to the on-chip RC oscillator. OUT1 and OUT2 are connection terminals for the external RC components. In addition, an on-chip monostable circuit is provided to allow a variable pulse width output. Various timing functions can be achieved using combinations of these capabilities.

A logic 1 on the 8-BYPASS input enables a bypass of the first 8 stages and makes stage 9 the first counter stage of the last 16 stages. Selection of 1 of 16 outputs is accomplished by the decoder and the BCD inputs A, B, C and D. MONO IN is the timing input for the on-chip monostable oscillator. Grounding of the MONO IN terminal through a resistor of 10K ohms or higher, disables the one-shot circuit and connects the decoder directly to the DECODE OUT terminal. A resistor to V_{DD} and a capacitor to ground from the MONO IN terminal enables the one-shot circuit and controls its pulse width.

A fast test mode is enabled by a logic 1 on 8-BYPASS, SET, and RESET. This mode

Features:

- 24 flip-flop stages — counts from 2^0 to 2^{24}
- Last 16 stages selectable by BCD select code.
- Bypass input allows bypassing first 8 stages
- On-chip RC oscillator provision
- Clock inhibit input
- Schmitt-trigger in clock line permits operation with very long rise and fall times
- On-chip monostable output provision
- Typical $f_{CL} = 3$ MHz at $V_{DD} = 10$ V
- Test mode allows fast test sequence
- Set and reset inputs
- Capable of driving two low power TTL loads, one lower-power Schottky load, or two HTL loads over the rated temperature range
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

divides the 24-stage counter into three 8-stage sections to facilitate a fast test sequence.

The CD4536B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (DW, DWR, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).



RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	Min.	Max.	
Supply-Voltage Range (For T_A = Full Package Temperature Range)	3	18	V

DECODE OUT SELECTION TABLE

D	C	B	A	NUMBER OF STAGES IN DIVIDER CHAIN	
				8-BYPASS = 0	8-BYPASS = 1
0	0	0	0	9	1
0	0	0	1	10	2
0	0	1	0	11	3
0	0	1	1	12	4
0	1	0	0	13	5
0	1	0	1	14	6
0	1	1	0	15	7
0	1	1	1	16	8
1	0	0	0	17	9
1	0	0	1	18	10
1	0	1	0	19	11
1	0	1	1	20	12
1	1	0	0	21	13
1	1	0	1	22	14
1	1	1	0	23	15
1	1	1	1	24	16

0 = Low Level 1 = High Level

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal) -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS -0.5V to $V_{DD} + 0.5V$

DC INPUT CURRENT, ANY ONE INPUT ± 10 mA

POWER DISSIPATION PER PACKAGE (P_D):

For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$ 500 mW

For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$ Derate Linearly at 12 mW/ $^\circ\text{C}$ to 200 mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100 mW

OPERATING-TEMPERATURE RANGE (T_A) -55°C to $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE (T_{stg}) -65°C to $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance $1/16 \pm 1/32$ inch (1.59 ± 0.79 mm) from case for 10 s max $+265^\circ\text{C}$

CD4536B Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	—	0.5	5	5	5	150	150	—	0.04	5	μA
	—	0.10	10	10	10	300	300	—	0.04	10	
	—	0.15	15	20	20	600	600	—	0.04	20	
	—	0.20	20	100	100	3000	3000	—	0.08	100	
Output Low (Sink) Current I _{OL} Min.	0.4	0.5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA
	0.5	0.10	10	1.6	1.5	1.1	0.9	1.3	2.6	—	
	1.5	0.15	15	4.2	4	2.8	2.4	3.4	6.8	—	
Output High (Source) Current, I _{OH} Min.	4.6	0.5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	mA
	2.5	0.5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—	
	9.5	0.10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—	
	13.5	0.15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—	
Output Voltage: Low-Level, V _{OL} Max.	—	0.5	5	0.05				—	0	0.05	V
	—	0.10	10	0.05				—	0	0.05	
	—	0.15	15	0.05				—	0	0.05	
Output Voltage: High-Level, V _{OH} Min.	—	0.5	5	4.95				4.95	5	—	V
	—	0.10	10	9.95				9.95	10	—	
	—	0.15	15	14.95				14.95	15	—	
Input Low Voltage V _{IL} Max.	0.5, 4.5	—	5	1.5				—	—	1.5	V
	1.9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V _{IH} Min.	0.5, 4.5	—	5	3.5				3.5	—	—	V
	1.9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current I _{IN} Max.	—	0.18	18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA

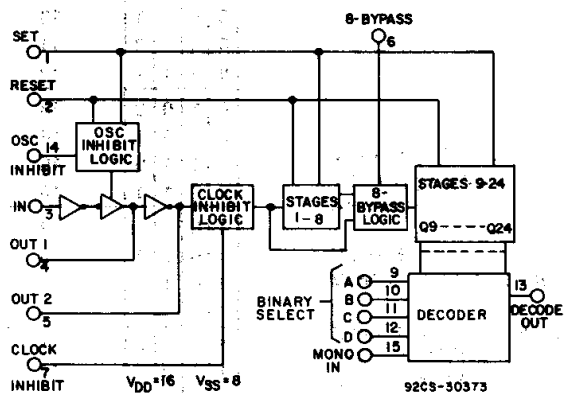


Fig. 1 — Functional block diagram.

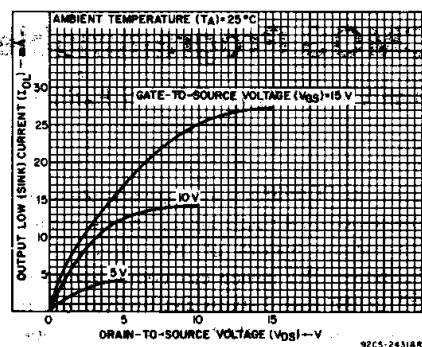


Fig. 2—Typical output low (sink) current characteristics.

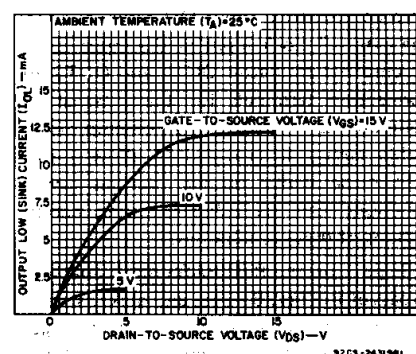


Fig. 3—Minimum output low (sink) current characteristics.

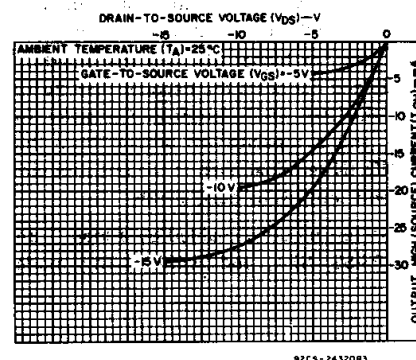


Fig. 4—Typical output high (source) current characteristics.

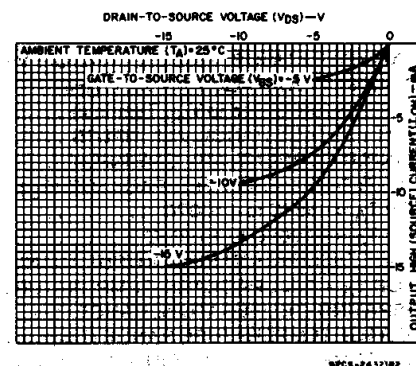


Fig. 5—Minimum output high (source) current characteristics.

CD4536B Types

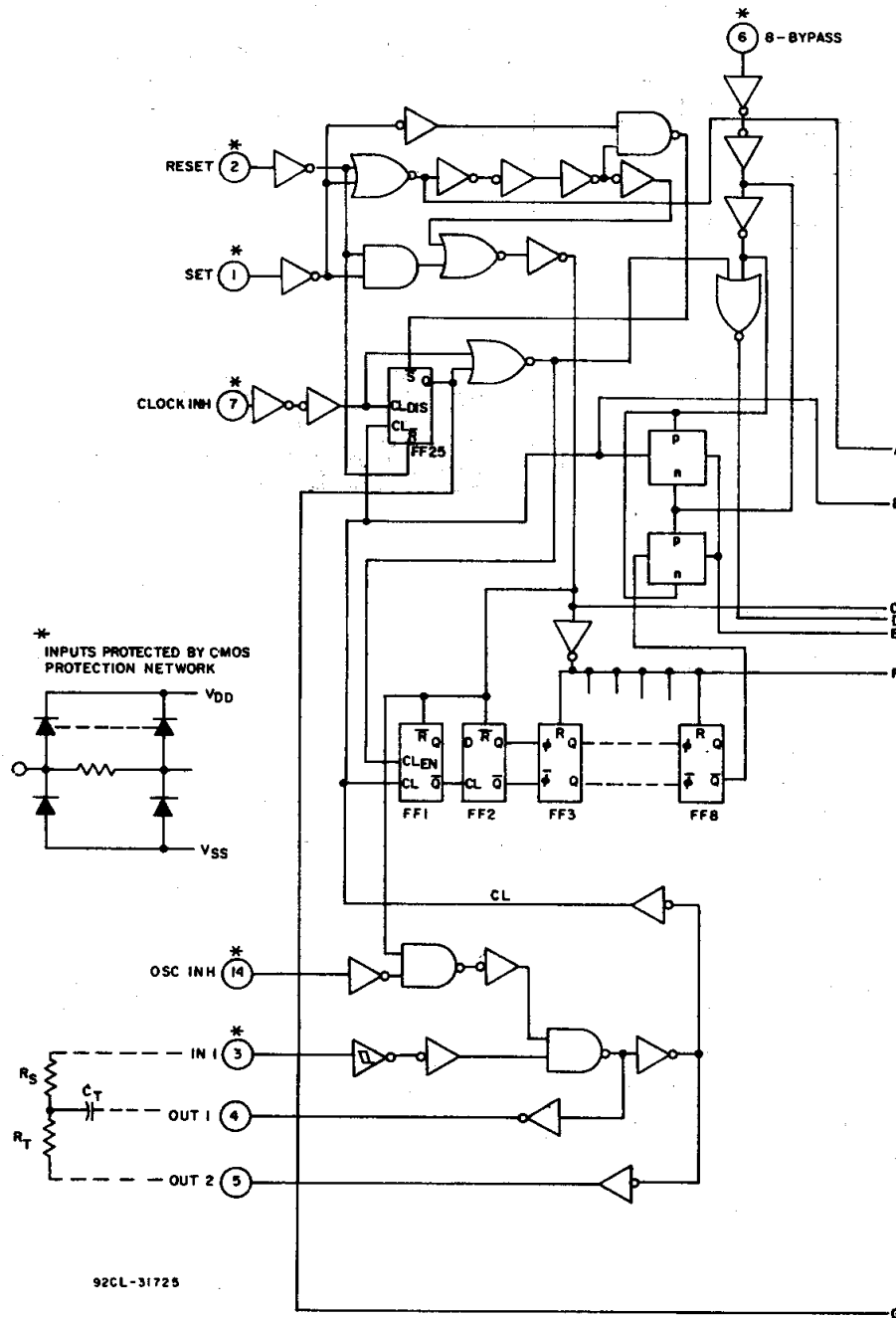


Fig.6 - Logic diagram for CD4536B [continued on next page].

NOTE: $f \approx \frac{1}{3R_T C_T}$, $R_S \approx (5 \rightarrow 10) \times R_T$

CD4536B Types

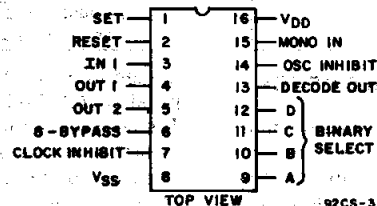


Fig.6 - Logic diagram for CD4536B [continued from previous page].

CD4536B Types

DYNAMIC ELECTRICAL CHARACTERISTICS, at $T_A = 25^\circ\text{C}$, Input $t_r, t_f = 20\text{ ns}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$

CHARACTERISTIC	V_{DD} (V)	LIMITS			UNITS
		Min.	Typ.	Max.	
Propagation Delay Times:	5	—	1	2	μs
Clock to Q1, 8-Bypass High	10	—	0.5	1	
t_{PHL}, t_{PLH}	15	—	0.35	0.7	
Clock to Q1, 8-Bypass Low	5	—	2.5	5	μs
t_{PHL}, t_{PLH}	10	—	0.8	1.6	
	15	—	0.6	1.2	
Clock to Q16, t_{PHL}, t_{PLH}	5	—	4	8	μs
	10	—	1.5	3	
	15	—	1	2	
Q_n to Q_{n+1} , t_{PHL}, t_{PLH}	5	—	150	300	ns
	10	—	75	150	
	15	—	50	100	
Set to Q_n , t_{PLH}	5	—	300	600	ns
	10	—	125	250	
	15	—	80	160	
Reset to Q_n , t_{PHL}	5	—	3	6	μs
	10	—	1	2	
	15	—	0.75	1.5	
Transition Time, t_{THL}, t_{TLH}	5	—	100	200	ns
	10	—	50	100	
	15	—	40	80	
Minimum Pulse Widths:	5	—	200	400	ns
Clock	10	—	75	150	
	15	—	50	100	
Set	5	—	200	400	ns
	10	—	100	200	
	15	—	60	120	
Reset	5	—	3	6	μs
	10	—	1	2	
	15	—	0.75	1.5	
Minimum Set Recovery Time,	5	—	2.5	5	μs
	10	—	1	2	
	15	—	0.6	1.6	
Minimum Reset Recovery Time,	5	—	3.5	7	μs
	10	—	1.5	3	
	15	—	1	2	
Maximum Clock Pulse Input Frequency, f_{CL}	5	0.5	1	—	MHz
	10	1.5	3	—	
	15	2.5	5	—	
Maximum Clock Pulse Input Rise or Fall Time, t_r, t_f	5, 10, 15	Unlimited			μs



Terminal Assignment



Fig. 7—Typical propagation delay time as a function of load capacitance (CLOCK to Q1, 8-BYPASS high).

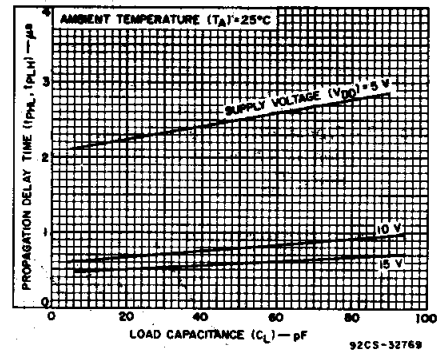


Fig. 8—Typical propagation delay time as a function of load capacitance (CLOCK to Q1, 8-BYPASS low).

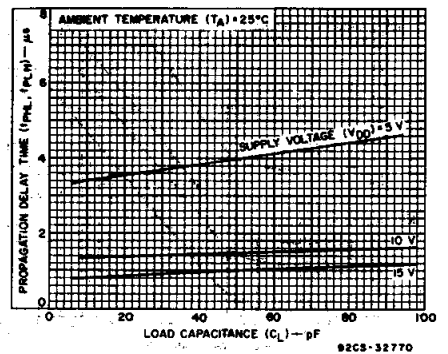


Fig. 9—Typical propagation delay time as a function of load capacitance (CLOCK to Q16, 8-BYPASS high).

CD4536B Types



Fig. 10—Typical propagation delay time as a function of load capacitance (Q_N to $Q_N + 1$).



Fig. 11—Typical RC oscillator frequency deviation as a function of supply voltage.

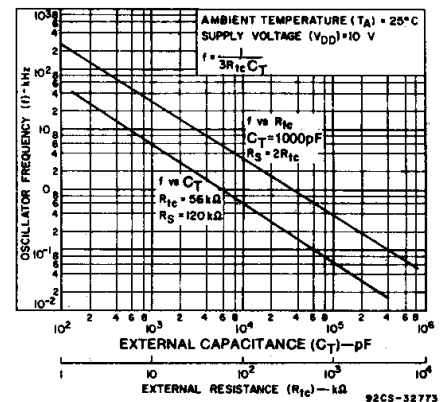


Fig. 12—Typical RC oscillator frequency deviation as a function of time constant resistance and capacitance.



Fig. 13—Typical RC oscillator frequency deviation as a function of ambient temperature ($R_S = 0$).

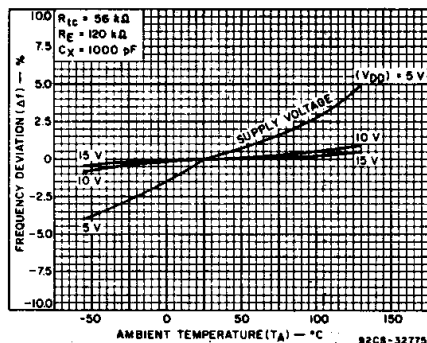


Fig. 14—Typical RC oscillator frequency deviation as a function of ambient temperature ($R_S = 120 \text{ k}\Omega$).



Fig. 15—Typical pulse width as a function of external capacitance ($V_{DD} = 5 \text{ V}$).



Fig. 16—Typical pulse width as a function of external capacitance ($V_{DD} = 10 \text{ V}$).



Fig. 17—Typical pulse width as a function of external capacitance ($V_{DD} = 15 \text{ V}$).

Functional Test Sequence

Inputs					Outputs	Comments
In ₁	Set	Reset	8-Bypass	Decode Out Q1 thru Q24		
1	0	1	1	0		All 24 steps are in Reset mode
1	1	1	1	0		Counter is in three 8-stage section in parallel mode
0	1	1	1	0		First "1" to "0" transition of clock
1	—	—	—	—		
—	1	1	1	—		255 "1" to "0" transitions are clocked in the counter
0	1	1	1	1		The 255 "1" to "0" transition
0	0	0	0	1		Counter converted back to 24 stages in series mode
1	0	0	0	1		Set and Reset must be connected together and simultaneously go from "1" to "0"
0	0	0	0	0		In ₁ Switches to a "1"
0	0	0	0	0		Counter Ripples from an all "1" state to an all "0" state

FUNCTIONAL TEST SEQUENCE

Test Function (Figure 23) has been included for the reduction of test time required to exercise all 24 counter stages. This test function divides the counter into three 8-stage sections and 255 counts are

loaded in each of the 8-stage sections in parallel. All flip-flops are now at a "1". The counter is now returned to the normal 24-steps in series configuration. One more pulse is entered into In₁ which will cause the counter to ripple from an all "1" state to an all "0" state.

CD4536B Types



Fig. 18—Typical transition time as a function of load capacitance.

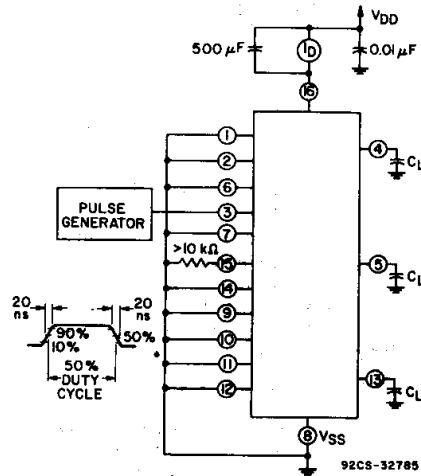


Fig. 20—Dynamic power dissipation test circuit and waveform.



19—Typical dynamic power dissipation as a function of input pulse frequency.

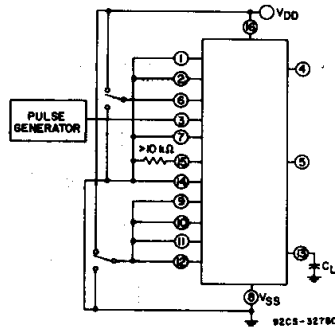


Fig. 21—Switching time test circuit.

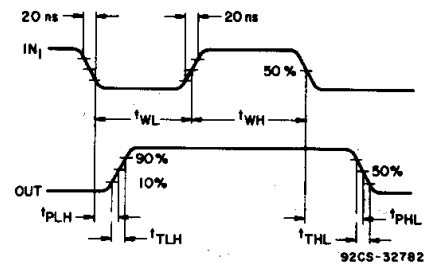


Fig. 22—Input waveforms for switching-time test circuit.

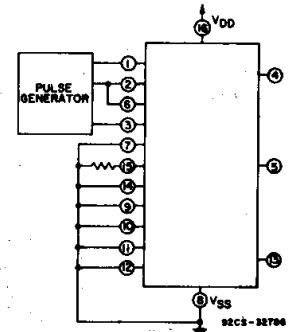


Fig. 23—Functional test circuit.

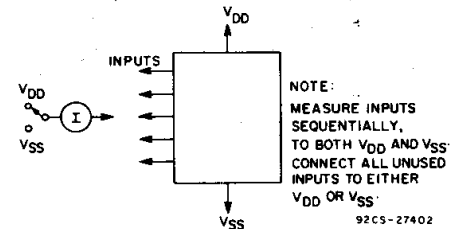


Fig. 24—Input-current test circuit.

TRUTH TABLE

IN1	SET	RESET	CLOCK INH	OSC INH	OUT1	OUT2	DECODE OUT
	0	0	0	0			No Change
	0	0	0	0			Advance to Next State
X	1	0	0	0	0	1	1
X	0	1	0	0	0	1	0
X	0	0	1	0			No Change
0	0	0	0	X	0	1	No Change
1	0	0	0				Advance to Next State

0 = Low Level 1 = High Level X = Don't Care

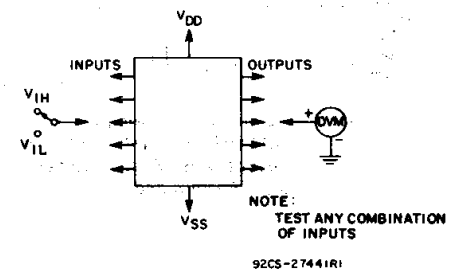


Fig. 25—Input-voltage test circuit.

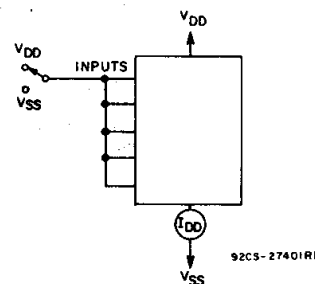


Fig. 26—Quiescent-device current test circuit.

CD4536B Types

APPLICATIONS

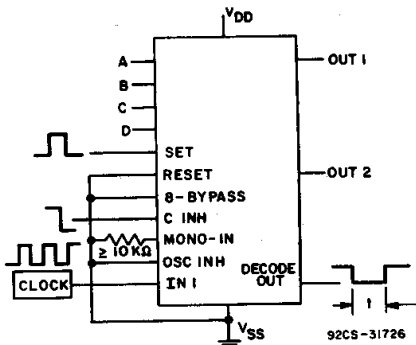


Fig. 27—Time interval configuration using external clock; set and clock inhibit functions.

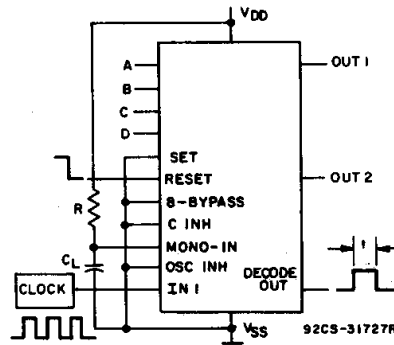


Fig. 28—Time interval configuration using external clock; reset and output monostable to achieve a pulse output.

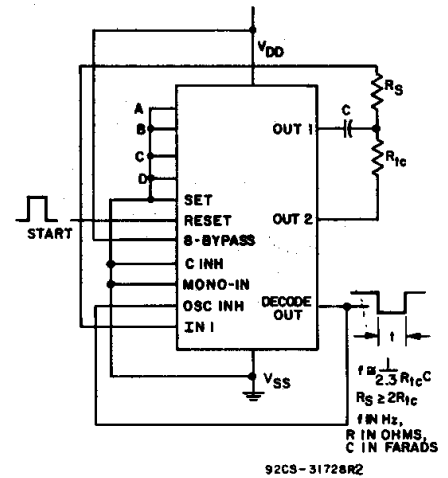


Fig. 29—Time interval configuration using on-chip RC oscillator and reset input to initiate time interval.

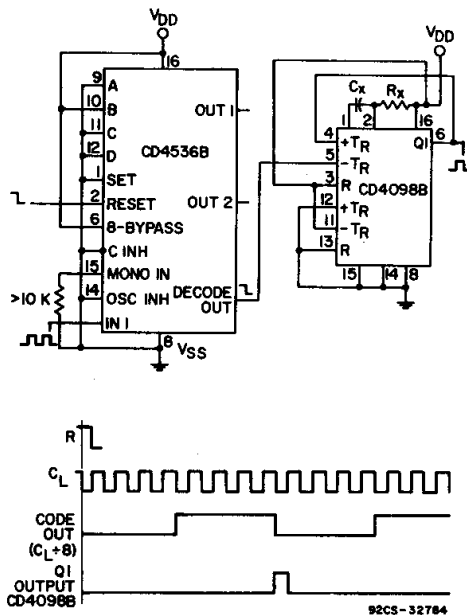


Fig. 30—Application showing use of CD4098B and CD4536B to get decode pulse 8 clock pulses after Reset pulse.

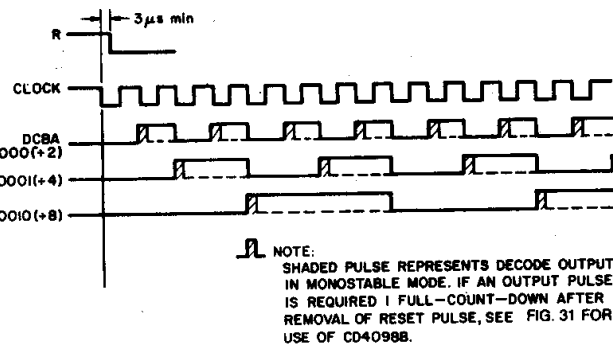
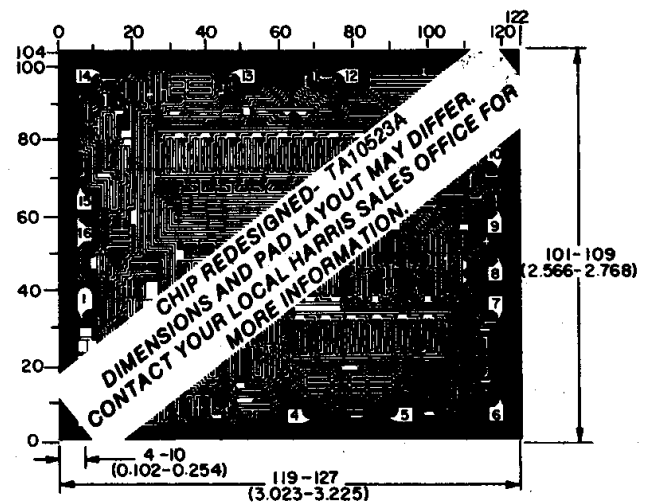


Fig. 31—CD4536B Timing Diagram.

Dimensions and pad layout for CD4536BH.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).



92CM-32787

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CD4536BDW	Active	Production	SOIC (DW) 16	40 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536BM
CD4536BDW.A	Active	Production	SOIC (DW) 16	40 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536BM
CD4536BDWR	Active	Production	SOIC (DW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536BM
CD4536BDWR.A	Active	Production	SOIC (DW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536BM
CD4536BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4536BE
CD4536BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4536BE
CD4536BEE4	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4536BE
CD4536BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4536BF3A
CD4536BF3A.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4536BF3A
CD4536BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536B
CD4536BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4536B
CD4536BPW	Active	Production	TSSOP (PW) 16	90 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B
CD4536BPW.A	Active	Production	TSSOP (PW) 16	90 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B
CD4536BPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B
CD4536BPWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B
CD4536BPWRE4	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B
CD4536BPWRG4	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM536B

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF CD4536B, CD4536B-MIL :

- Catalog : [CD4536B](#)
- Military : [CD4536B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD4536BDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
CD4536BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD4536BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4536BDWR	SOIC	DW	16	2000	350.0	350.0	43.0
CD4536BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD4536BPWR	TSSOP	PW	16	2000	353.0	353.0	32.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD4536BDW	DW	SOIC	16	40	506.98	12.7	4826	6.6
CD4536BDW.A	DW	SOIC	16	40	506.98	12.7	4826	6.6
CD4536BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4536BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4536BEE4	N	PDIP	16	25	506	13.97	11230	4.32
CD4536BPW	PW	TSSOP	16	90	530	10.2	3600	3.5
CD4536BPW.A	PW	TSSOP	16	90	530	10.2	3600	3.5



PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

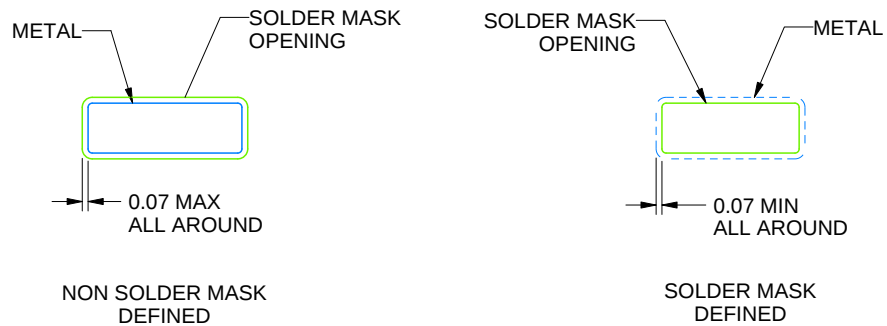
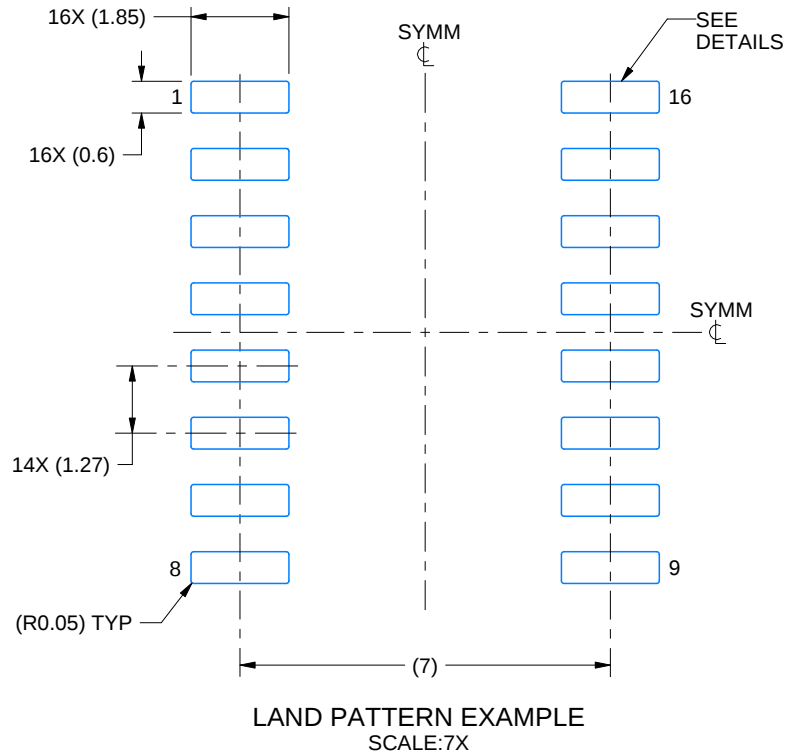
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
 BASED ON 0.125 mm THICK STENCIL
 SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

GENERIC PACKAGE VIEW

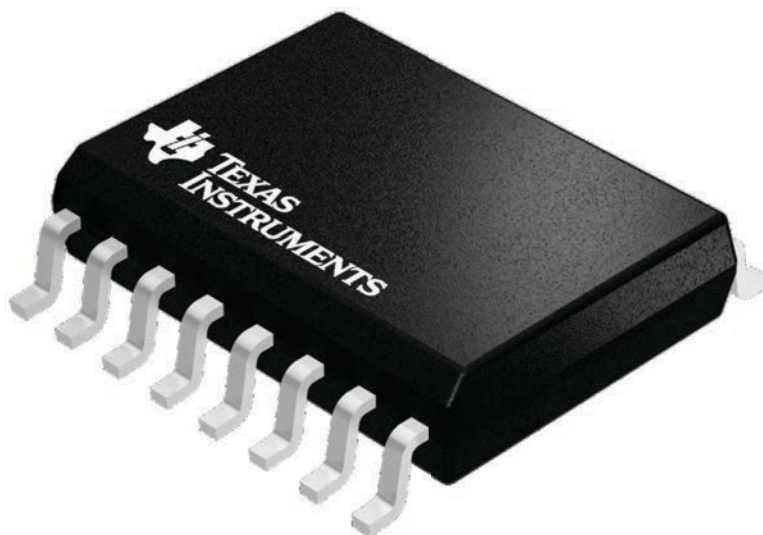
DW 16

SOIC - 2.65 mm max height

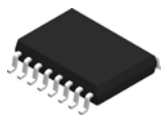
7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4224780/A

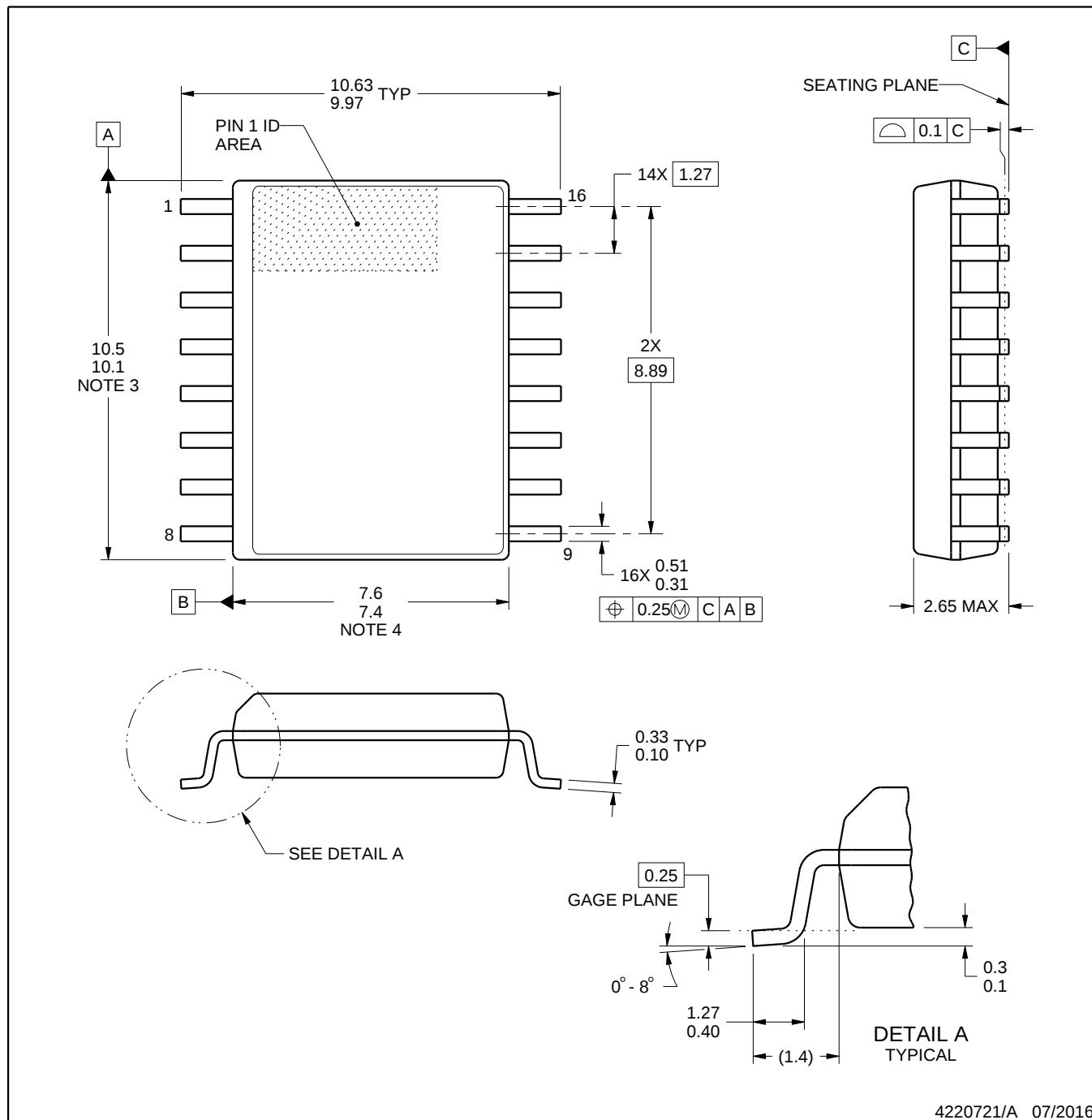


DW0016A

PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220721/A 07/2016

NOTES:

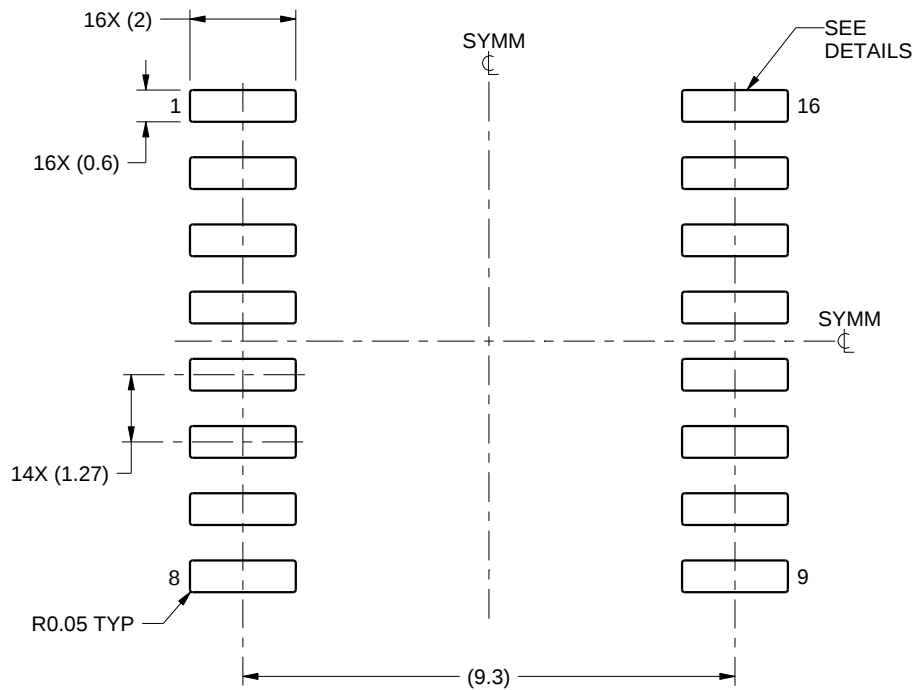
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

EXAMPLE BOARD LAYOUT

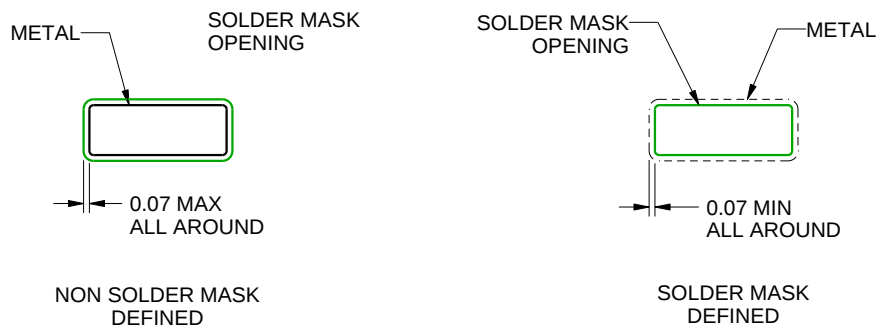
DW0016A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:7X



SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

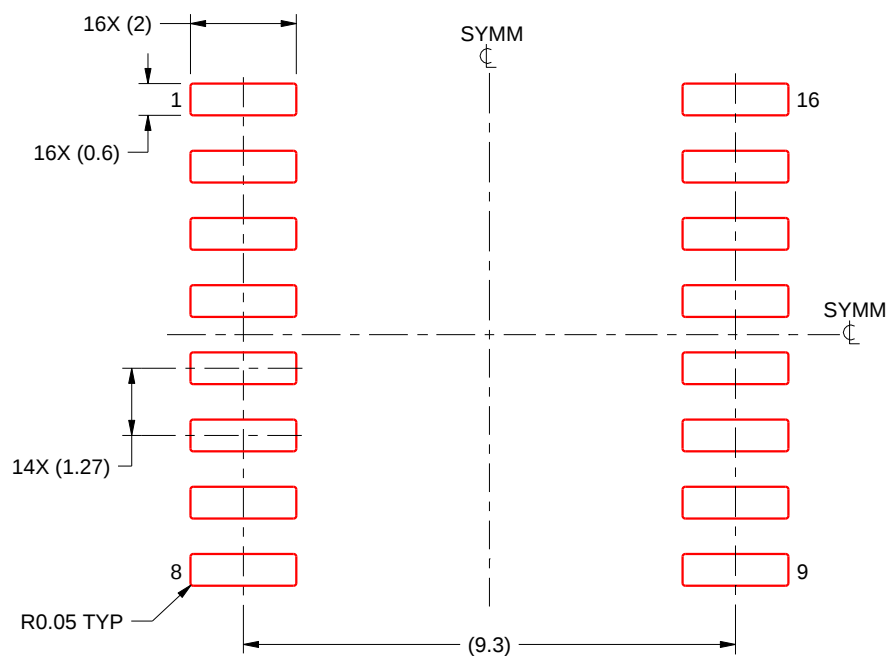
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DW0016A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220721/A 07/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

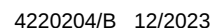
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.



PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



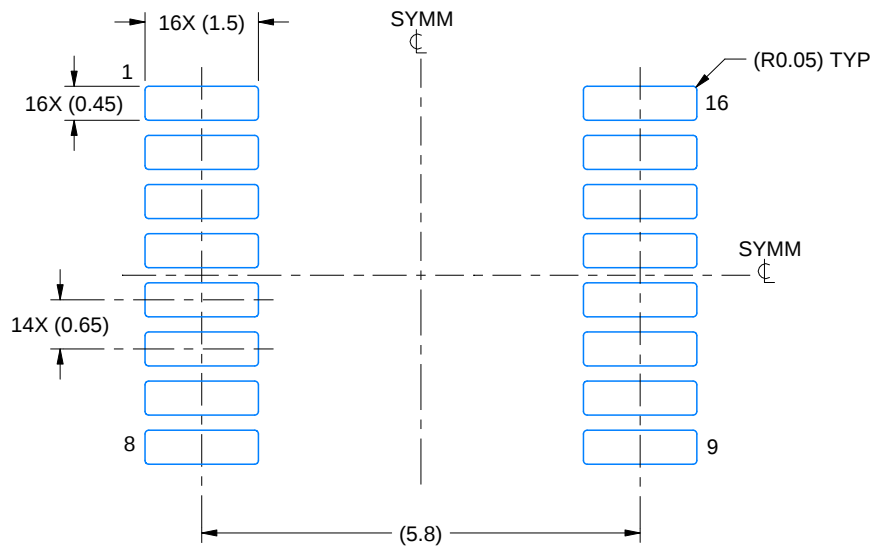
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

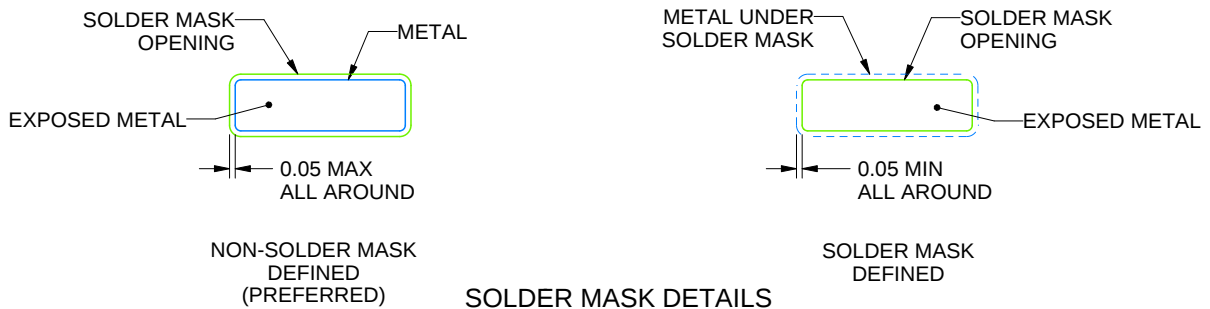
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220204/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/B 12/2023

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025